**Response of the water cycle of West Africa and Atlantic to radiative forcing by Saharan dust**

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The responses of the atmospheric water cycle and climate of West Africa and the Atlantic toradiative forcing of Saharan dust are studied using the NASA finite volume general circulation model (fvGCM), coupled to a mixed layer ocean. We find evidence in support of the "elevated heat pump" (EHP) mechanism that underlines the responses of the atmospheric water cycle to dust forcing as follow. During the boreal summer, as a result of large-scale atmospheric feedback triggered by absorbing dust aerosols, rainfall and cloudiness are enhanced over the West Africa/Eastern Atlantic ITCZ, and suppressed over the West Atlantic and Caribbean region. Shortwave radiation absorption by dust warms the atmosphere and cools the surface, while longwave has the opposite response. The elevated dust layer warms the air over West Africa and the eastern Atlantic. As the warm air rises, it spawns a large-scale onshore flow carrying the moist air from the eastern Atlantic and the Gulf of Guinea. The onshore flow in turn enhances the deep convection over West Africa land, and the eastern Atlantic. The condensation heating associated with the induced deep convection drives and maintains an anomalous large-scale east-west overturning circulation with rising motion over West Africa/eastern Atlantic, and sinking motion over the Caribbean region. The response also includes a strengthening of the West African monsoon, manifested in a northward shift of the West Africa precipitation over land, increased low-level westerlies flow over West Africa at the southern edge of the dust layer, and a near surface westerly jet underneath the dust layer over the Sahara. The dust radiative forcing also leads to significant changes in surface energy fluxes, resulting in cooling of the West African land and the eastern Atlantic, and warming in the West Atlantic and Caribbean. The EHP effect is most effective for moderate to highly absorbing dusts, and becomes minimized for reflecting dust with single scattering albedo at 0.95 or higher.